PROC. ENTOMOL. SOC. WASH.
108(2), 2006, pp. 405–410

REDESCRIPTION OF *NEALIOLUS CURCULIONIS* (FITCH) (HYMENOPTERA: BRACONIDAE), WITH A NEW HOST RECORD AND DISTRIBUTION DATA

Victor López-Martínez, José Antonio Sánchez-Garciá, Antonio Huerta-Paniogua, Gloria Calyecac-Cortero, Néstor Bautista-Martínez, and José Isaac Figueroa-De la Rosa

(VL-M) Universidad Autónoma del Estado de Morelos, Facultad de Ciencias Agropecuarias, Av. Universidad 1001, Col. Chamilpa, Cuernavaca, Morelos 62210, México (e-mail: vilomar@uaem.mx); (JAS-G) CIIDIR-IPN-Unidad Oaxaca, Área de Control Biológico, Santa Cruz Xoxocotlán, Oaxaca, C.P. 71230, México: (AH-P, GC-C, NB-M, JIF-D) Colegio de Postgraduados, IFIT-Entomología, Km 35.5 carr. México-Texcoco, Montecillo, Edo. de México, C. P. 56230, México

Abstract.—A detailed description of the adult of *Nealiolus curculionis* (Fitch), with illustrations of diagnostic characters including the male genitalia, is provided. *Trichobaris championi* Barber (Coleoptera: Curculionidae), a pest of *Physalis ixocarpa* Brot., is reported as a new host record for *N. curculionis*. New distribution data in Mexico and the first records from Guatemala and Honduras are presented.

Key Words: Helconinae, Brachistini, Neotropical, husk tomato, stalk borer

Nealiolus curculionis (Fitch) is a member of the tribe Brachistini of the subfamily Helconinae. It has the forewing vein r-m absent, the first three metasonal tergites forming a carapace with metasomal terga I and II not fused, and the lateral tergite of the second tergum fused with the third. The genus *Nealiolus* can be identified as an member of the subfamily Helconinae using the keys of March et al. (19987), Shaw (1995), and Sharkey (1997).

In México, *N. curculionis* has been reported as a parasite of *Anthonomus grandis* Boheman (Coleoptera: Curculionidea), a pest of *Gossypium hirsutum* L. in Guerrero (Cross and Chesnut 1971). In the United Staes, *N. curculionis* is rocognized as the principal natural enemy of *Cylindrocopturus adspersus* (LeCOnte) (Coleoptera: Curculionidae) (Charlet 1983b), and it is associated at least with ten curculionid species in Canada, México, and the United States (Charlet 1983a, 1994; Charlet et al. 1992; Marsh 1979).

Specimens collected in the Mexican State of Puebla revealed a wasp species found emerging from *Trichobaris championi* Barber pupae on stems and branches from husk tomato, *Physalis ixocarpa* Brot. Study of these specimens revealed that they are *Nealiolus curculionis*. This represents a new host record for *N. curculionis*.

This species is redescribed as a necessary part of a forthcoming paper of the Mexican Braconidae fauna (López, in preparation). Furthermore, the male genitalia of *N. curculionis* is described for the first time, and we describe the potential of this structure as morphological character in future systematic studies of the genus. We also present new data about its distribution in three Central American countries.

Materials and Methods

Specimens were reared from husk tomato containing *T. championi* pupae as part of a bioecological pests program through the Universidad Autónoma del Estado de Morelos, Colegio de Postgraduados and CONACYT, in central Mexico. Other specimens were borrowed from the following collections: Canadian National Collection, Ottawa, John. T. Huber (CNC) and Museum of Zoology, Lund University, Sweden, Roy Danielsson (MZUL). The Mexican material is housed in the Colección Entomológica del Instituto de Fitosanidad (CEAM) and the Facultad de Ciencias Agropecuarias, Universidad Autónoma del Estado de Morelos (VLM).

Measurements were performed using an image analyzer Image Pro plus version 3.1 (Media Cybernetics 1997) adapted to a video camera (Hitachi KP-D51) and a microscope (Olympus BX- 50). Terminology follows Sharkey and Wharton (1997) and Martin (1956). We examined male genitalia of 15 specimens from different localities. Preparation technique and terminology of genitalia follows Sánchez-García et al. (2003).

Results

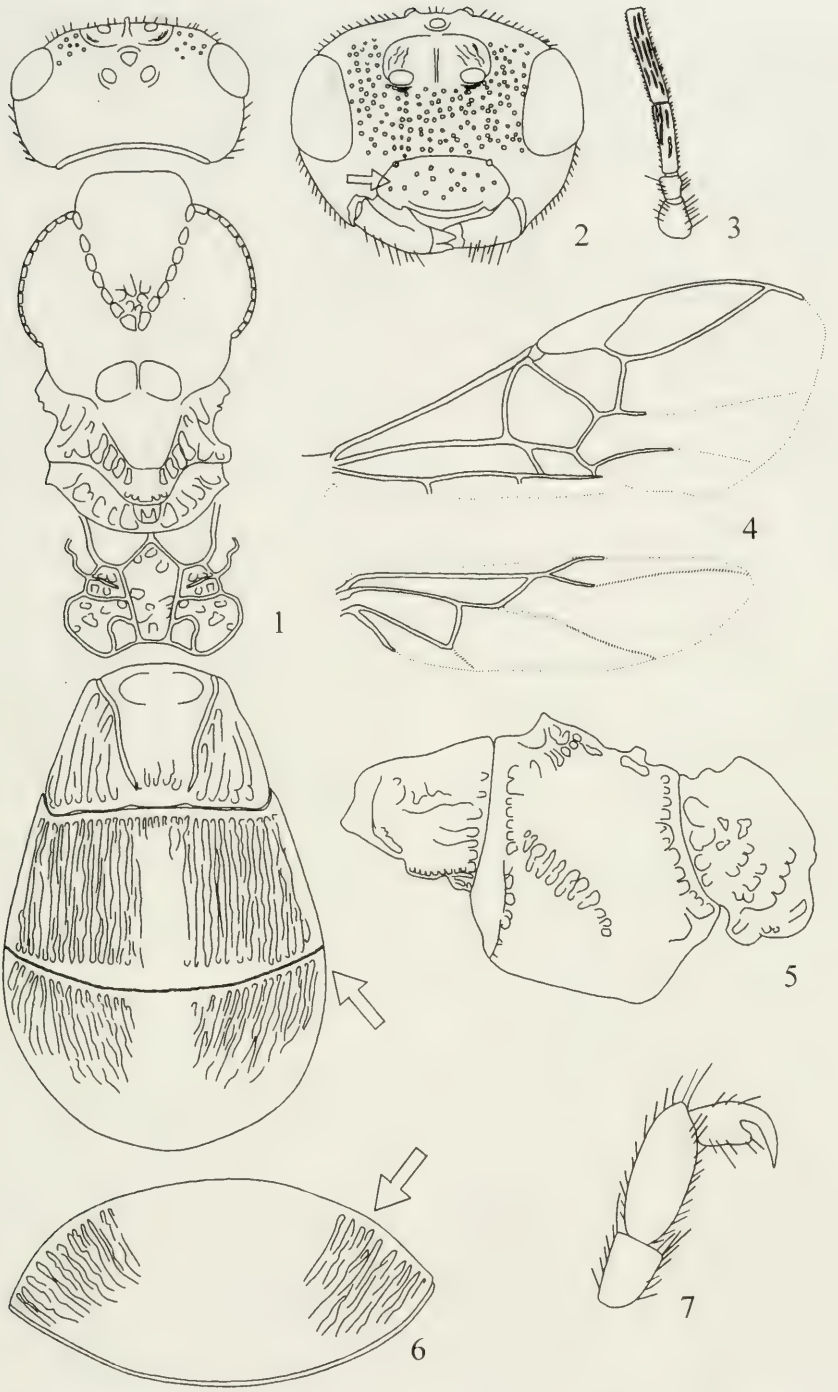
Nealiolus curculionis (Fitch) (Figs. 1–9)

Female.—Body length: 3.87 mm. *Color:* Body black, except following: legs brown, hind tibia dark brown basally; antenna dark brown; ovipositor and clypeus brown; metasoma dark brown; mandible brown; apically dark brown.

Head: Quadrate in front view (Fig. 2); setae sparse on face, clypeus and mandibles; vertex temple and gena evenly setose; face surface punctate, vertex, temple and gena polished, fine rugae below antennal fosae; frons polished with shallow and scarce sculptured depressions, but with a strong short carina; face 2.66 times higher than wide; clypeus transverse, 2.31 times wider than high, ventral margin strongly rounded, and with an obtuse angulation near base of each mandible; mandible base width 0.12 mm; eye 1.61 times higher than wide; ocelli partially surrounded by an impressed groove; antenna shorter than body, length 3.43 mm, with 27 flagellomeres, irregular placodes present in flagellomeres I–X, first flagellomere shorted than second (Fig. 3).

Mesosoma: 1.31 times longer than high; lateral face of pronotum strongly sculptured on medial surface; notaulus deeply impressed, strongly foveolate and converging in a foveolate area (Fig. 1); scutellar sulcus deeply impressed, polished and with a distinct midridge; posterior margin of scutellum with long foveola; sternaulus deeply impressed (Fig. 5), epicnemial carina with finely rugulose striae; metapleuron densely and uniformly rugose with short whitish setae; propodeum rugose, with a distinct pentagonal areola, inner surface punctate; lateral protuberances almost absent, propodeal spiracle raised at surface level; propodeal carina short. Forewing 3 times longer than high (Fig. 4); stigma broad 3.94 times longer than high; 1Cub 3.8 times longer than 1Cua; 1M distinctly bowed; (RS+M)a sinuate; im-cu 1.8 times longer than (Rs+M)a sinuate; 1m-cu 1.8 times longer than (rs+M)b, 2cu-a present; R1a 4.4 times longer than R1b, the latter not extending to wing tip. Hind wing 4.15 times higher than wide; M+CU 3.13 times longer than 1M. Hind femur short, broad, 4.47 times longer than maximum width; hind tibia 6.2 times longer than basal width; tarsonmeres II–IV 1.58 times longer than first tarsomere; tarsal claws with distinct basal tooth (Fig. 7).

Metasoma: Carapace oval, short in dorsal view (Fig. 1), length 1.56 mm; first transverse groove well developed and movable, second groove as a fine transverse line; first terguite with centro-lateral carinae strongly developed, reaching first groove, first tergite with a strong lateral lamella, extending from point of articulation with thorax to first transverse groove (Fig. 1); third



Figs. 1–7. *Nealiolus curculionis*. 1, Dorsal view. 2, Frontal view of head. 3, Basal flagellomeres. 4, Wings. 5, Lateral view of mesosoma. 6, End view of carapace. 7, Posterior tarsal claw.

tergite with a very narrow, delicate, lateral lamella (Fig. 6); first two tergites longitudinally striate, second tergite with a polished and unsculptured medial area; striae on both first and second tergites not reaching transversal grooves (Figs. 1, 6, 8). Ovipositor length 2.78 mm.

Male genitalia: Male specimens with a simple pattern: Aedeagus bifid with two apical lobes, a medial deep canal, and apical pits; gonoforceps wider, its apical part rounded and with some lobes, with many straight apical setae and some at its median part; digitus with three or four teeth; cuspis pointed, lamina volsellaris with six setae (Fig. 9).

Variation.—Female length 3.79 mm (3.87–3.96), male 3.78 mm (3.58–3.99). Striae on lateral pronotum variable in number and size, many specimens with more longitudinal striae on basal margin. One male specimen with apex of carapace with a short distance concavity medio-ventrally.

Hosts.—*Trichobaris championi* associated with husk tomato (*P. ixocarpa*) in Mexico is a new host record for *N. curculionis*. Other host associations are *Anthonomus grandis* Boheman (in cotton squares) (Curculionidae), *Coccotorus scutellaris* (LeConte) (Curculionidea), *Conotrachelus nenuphar* (Herbst) (Curculionidae), *C.* near *tibialis* Schoof (Curculionidae), *C. posticatus*? Boheman (curculionidae), *Craponius inaequalis* (Say) (Curculionidae), *Cylindrocopturus adspersus* (LeConte) (Curculionidae), *Grapholita molesta* (Busck) (Tortricidae), *Magdalis armicollis* Say (in elm) (Curculionidae), and *Smicronyx fulvus* LeConte (in sunflower) (Curculionidae) (Carlet 1983a, b, 1994; Charlet et al. 1992; Marsh 1979; Martin 1956; Pinkham and Oseto 1987).

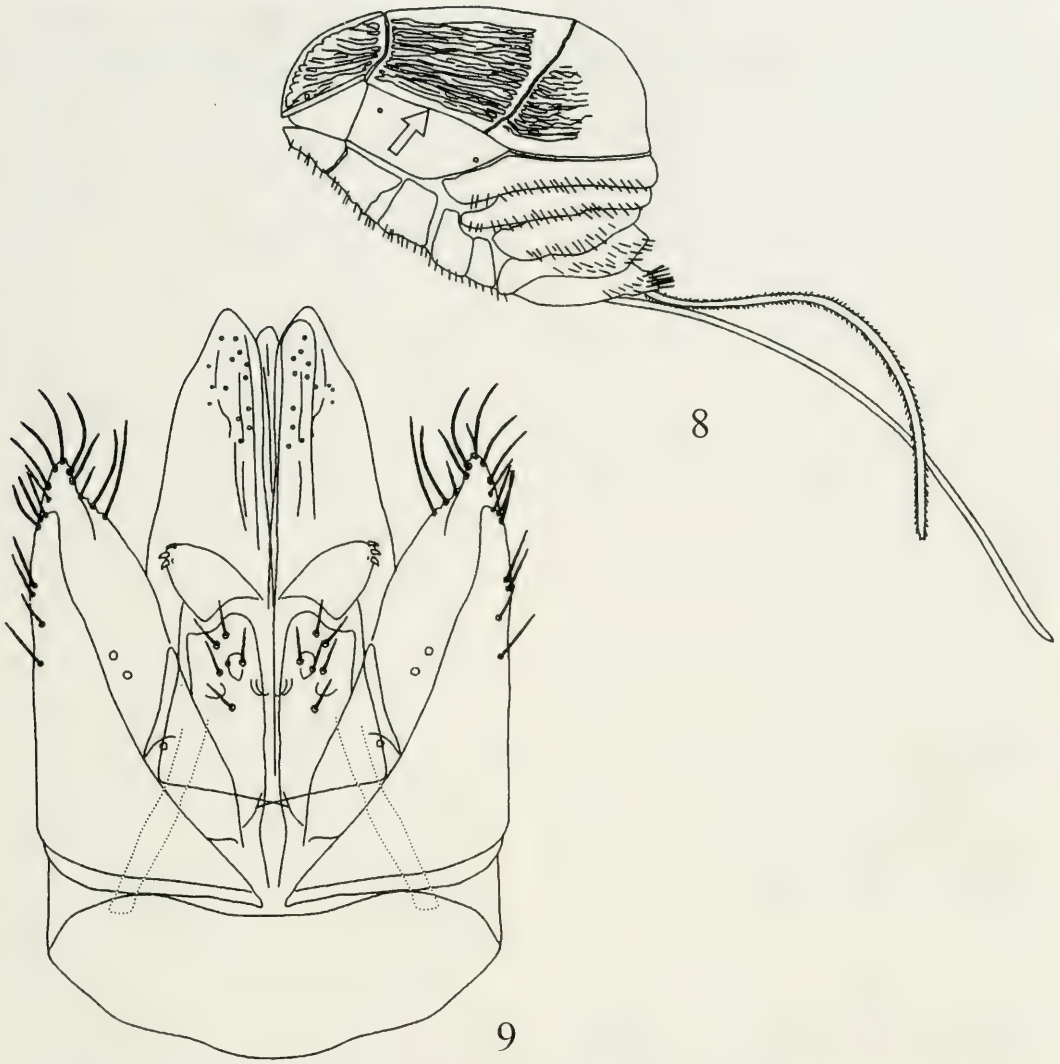
New distribution data.—Previously cited from Canada, United States, and México. We record it from Guatemala and Honduras. This species is also quite common in Costa Rica (S. Shaw, unpublished data).

GUATEMALA: 1 ♀, Zacapa, below San Lorenzo, XI/1986, 750 msnm, M. Sharkey (CNC). HONDURAS: 2 ♀, Atlantida, Lancetilla, Tela, 31/VIII/1995, leg. R. Cave, Malaise trap in lowland ran forest, 15°43′N 87°27′W (MZLU); 1 ♀, Yoro, Palo de Comba, 27/IX/1995, leg. R. Cave, Malaise trap in mid-elevation secondary forest, 15°11′N, 87°39′W (MZLU); 1 ♂, same data but 29/IX/1995; 3 ♂ and 2 ♀, same data but 5/VIII/1995; 1 ♀, same data but Yuscaran, 15°43′N. 87°27′W. MÉXICO: 2 ♀ and 2 ♂, Puebla, Tecamachalco, km 22 carr. Carretera México-Veracruz, 2-VIII-2000, Néstor Bautista, Tomate de cáscara *Physalis ixocarpa* Brot., hosp. *Trichobaris championi* (CEAM); 1 ♀, Puebla, Quecholac, Tuzuapán, 16-VI-2001, A, Huerta, tomate de cáscara, hosp. *Trichobaris championi* (CEAM); 2 ♀ and 1 ♂, same data but, 9-VI-2001. A. Huerta, Tomate de cáscara *Physalis ixocarpa* Brot., hosp. *Trichobaris championi* (VLM); 2 ♀, same data but, 16-VI-2001 (CEAM); 1 ♀, Tuzuapan, 24-VIII-2001, Antonio Huerta emerged from pupa of *Trichobaris championi* (VLM).

Diagnosis.—This species is quite similar to *Neoliolus rufus* (Riley), but *N. rufus* has a rufo-testaceous color. *Nealiolus curculionis* is a dark brown species with the clypeus transverse, third tergite finely striate, oval shaped and a slightly curved carapace.

Discussion

Trichobaris championi is a pest of husk tomato and is distributed in at least ten Mexican states (Barber 1935, Bautista and Morales 2000). Larvae of *T. championi* feed mainly on internal tissue of the stem and principal branches as a borer, while the mature larvae weave a cocoon with host fibers. This species hibernates as a pupa or adult in the husk tomato stems, and reaches 92% infestation levels in Tenango del Valle, Estado de México (Bautisa and Morales 2000) and 15.3% to 87.3% in the Puebla high plateau (Huerta et al. 2003). Our collections were made in commercial plots of husk tomato, where 10 insecticide applications are the regular program for *T. cham-*



Figs. 8–9. *Nealiolus curculionis*. 8, Lateral view of metasoma. 9, Male genitalia.

pioni control. From our collections only two braconids species were sampled, *N. curculionis* and an undetermined species of *Bracon*. *Nealiolus curculionis* represented 80% of the parasitoids reared from this host. The number of collected adults was low due to insecticide applications, but future collections in untreated fields may give a better idea of the impact of parasitism.

Nealiolus curculionis is an endoparasitoid of some curculionid species. The female oviposits into early first instar larvae and exhibits a great synchronization with its host (Charlet 1994).

The use of male genitalia for separation of species in Braconidae has been discussed by Sánchez-García et al. (2003). Male genitalia can provide useful characters for the higher classification for Braconidae, using setal patterns, dimensions of various structures, form of the gonoforceps, aedeagus, number and position of setae, and number of teeth on the digitus. It is a tool useful for separating species of Braconidae in several

genera including *Aphaereta* Foerster. *Blacus* Nees, *Digonogastra* Viereck, *Ephedrus* Haliday, *Epsilogaster* Whitfield and Mason, *Leiophron* Nees, *Triaspis* Haliday, and many genera of Microgastrinae. In the material used in this study, only one pattern of male genitalia was discovered for *N. curculionis* from the different localities analyzed. If this character is present in other species on the genus, it could provide a tool useful for separating species of *Nealiolus*.

Acknowledgments

Thanks to all collection managers listed in the Materials and Methods for loan of specimens, and to Robert W. Brooks, (Snow Entomological Collections, University of Kansas), Larry D. Charlet (Northern Crop Science Library, USDA), and Colin Favret (Illinois Natural History Survey) for loan of determined material of *Nealiolis curculionis*. Thanks to Charles O'Brien (Florida A&M University) for the corroboration of curculionid pest material. J. Romero N. reviewed the first draft of this paper. Thanks to two anonymous reviewers for helpful comments. This paper was funded by SNI-CONACYT (31351) and PIFI 2004-18-12 grants to the first author.

Literature Cited

Barber, H. S. 1935. The tobacco and solanum weevils of the genus *Trichobaris*. United States Department of Agriculture, Miscellaneous Publication 226, 28 pp.

Bautisa, M. N. and O. G. Morales. 2000. *Melanagromyza tomaterae* Steyskal (Diptera: Agromyzidae) plaga del tomate (*Physalis ixocarpa* Brot.) en México. Folia Entomológica Mexicana 110: 129–130.

Charlet, L. D. 1983a. Inset stem fauna of native sunflower species in western North Dakota. Environmental Entomology 12: 1286–1288.

———. 1983b. Parasitoids of a stem weevil, *Cylindrocopturus adspersus*(Coleoptera: Curculionidae) in sunflower: Incidence and parasitization in the northern Great Plains. Environmental Entomology 12: 888–890.

———. 1994. Seasonal abundance and impact of the sunflower stem weevil parasitoid, *Nealiolus curculionis* (Hymenoptera: Braconidae), in the northern Great Plains. Biological Control 4:26–31.

Charlet. L. D., G. L. Brewer, and V. H. Beregovoy. 1992. Insect fauna of the heads and stems of native sunflowers (Asterales: Asteraceae) in eastern North Dakota. Environmental Entomology 21: 493–500.

Cross, W. H. and T. L. Chesnut. 1971. Arthropod parasites of the boll weevil *Anthonomus grandis* 1. An annotated list. Annuals of the Entomological Society of America 64(2); 516–527.

Huerta P., R. A., N. Bautista M., and J. Romero N. 2003. Present status of *Trichobaris championi* Barber (Coleoptera: Curculionidae) in Mexico. Southwestern Entomologist 29(2): 153– 154.

Marsh, P. M. 1979. Family Braconidae, pp. 144-313. *In* Krombein, K. V., P. D. Hurd, D. R. Smith, and B. D. Burks, eds. Catalog of Hymenoptera in America North of Mexico, Vol. 1. Symphyta and Apocrita (Parasitica). Smithsonian Institution Press, Washington, D.C. pp. 1– 1198.

Marsh, P. M., S. R. Shaw, and R. A. Wharton. 1987. An identification manual for the North American genera of the Family Braconidae (Hymenoptera). Memoirs of the Entomological Society of Washington No. 13, 98 pp.

Martin, J. C. 1956. A taxonomic revision of the triaspidine braconid wasps of Nearctic America (Hymenoptera). Canadian Department of Agriculture Publication 965:1–157.

Media Cybernetics. 1997. Image-pro plus reference guide, version 3.1 for Windows, Media Cybernetics, Silver Spring, Maryland.

Pinkham, J. D. and C. Y. Oseto. 1987. Natural enemies and their maturity rates on *Smicronyx fulvus* LeConte (Coleoptera: Curculionidae) larvae. Environmental Entomology 16: 1302–1304.

Sánchez-García, J. A., R. A. Wharton, J. Romero-Nápoles, A. Gónzalez- Hernández, V. López-Martinez, A. Equihus-Martínez, H. González-Hernández, and J. L. Carrillo-Sánchez. 2003. Description of a new species of *Blacus* Nees (Hymenoptera: Braconidae) from Mexico, utilizing characters of the male external genitalia. Pan-Pacific Entomologist 79(2): 135–144.

Sharkey, M. J. 1997. Subfamily Key, pp. 39–64; Helconinae, pp. 261–274. *In* Wharton, R. A., P. M. Marsh, and M. J. Sharkey, eds. Manual of the New World Genera of the Family Braconidae (Hymenoptera). International Society of Hymenopterists. Special Publication No. 1, 439 pp.

Sharkey, M. J. and R. A. Wharton. 1997. Morphology and Terminology, pp. 19–37. *In* Wharton, R. A., P. M. Marsh, and M. J. Sharkey, eds. Manual of the New World Genera of the Family Braconidae (Hymenoptera). International Society of Hymenopterists. Special Publication No. 1, 439 pp.

Shaw, S. R. 1995. Braconidae. Chapter 12.2, pp. 431–463. *In* Hanson, P. E. and I. Gauld, eds. The Hymenoptera of Costa Rica, Oxford University Press, Oxford, 893 pp.